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(54) **CONTROL STRUCTURE OF ENGINE THROTTLE VALVE**

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F02D 9/10 (2006.01)
F02D 9/00 (2006.01)

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CPC .. ***F02D 9/10*** (2013.01); ***F02D 9/08*** (2013.01); ***F02D 9/1055*** (2013.01)

(58) **Field of Classification Search**
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USPC 123/337, 382; 251/129.01, 129.02, 251/129.11
See application file for complete search history.

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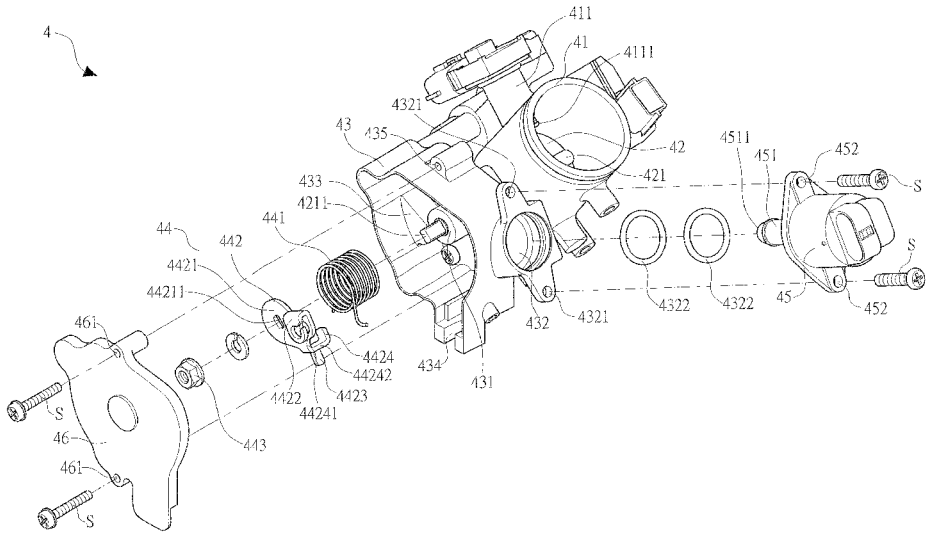
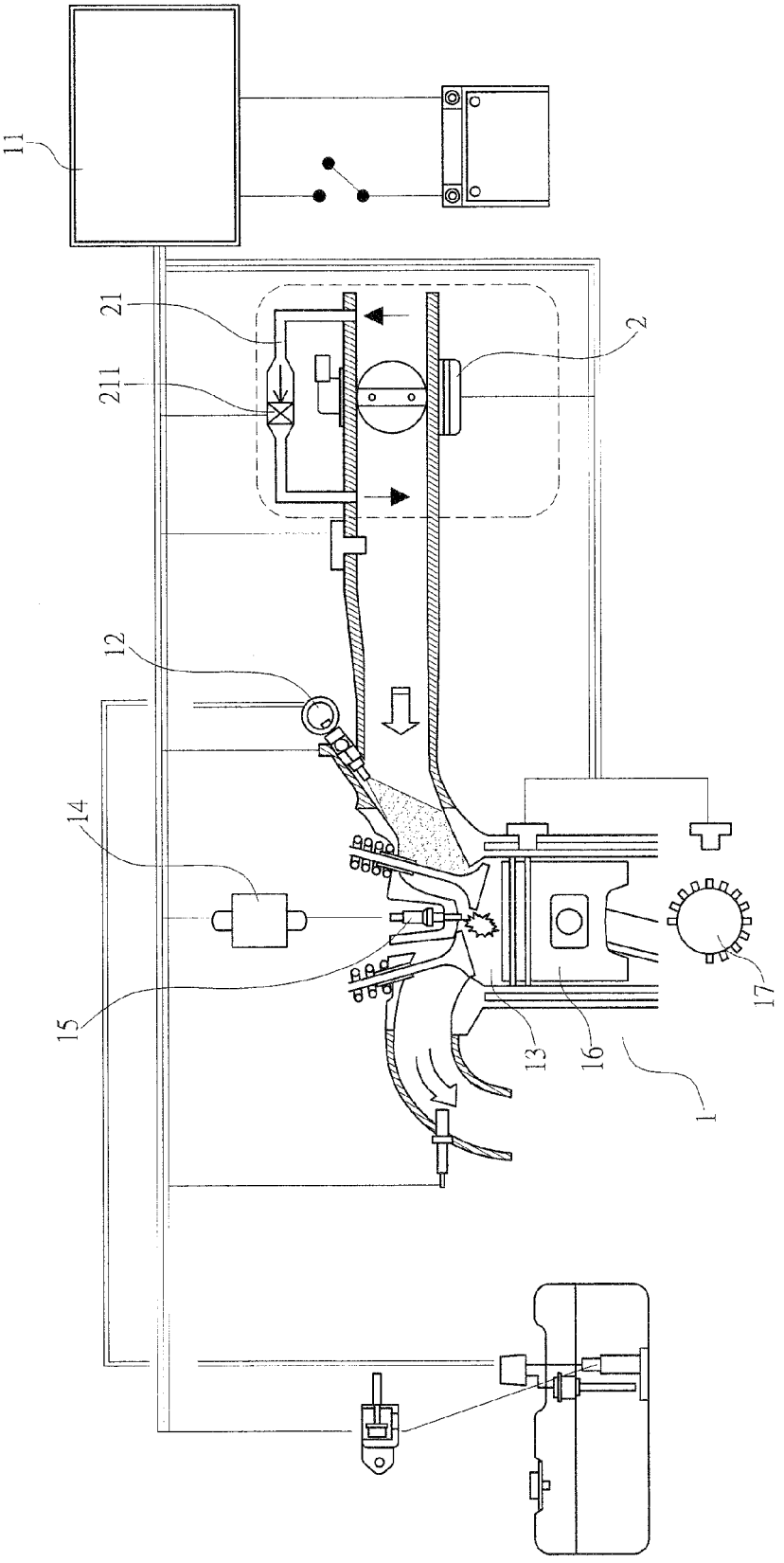
(57) **ABSTRACT**

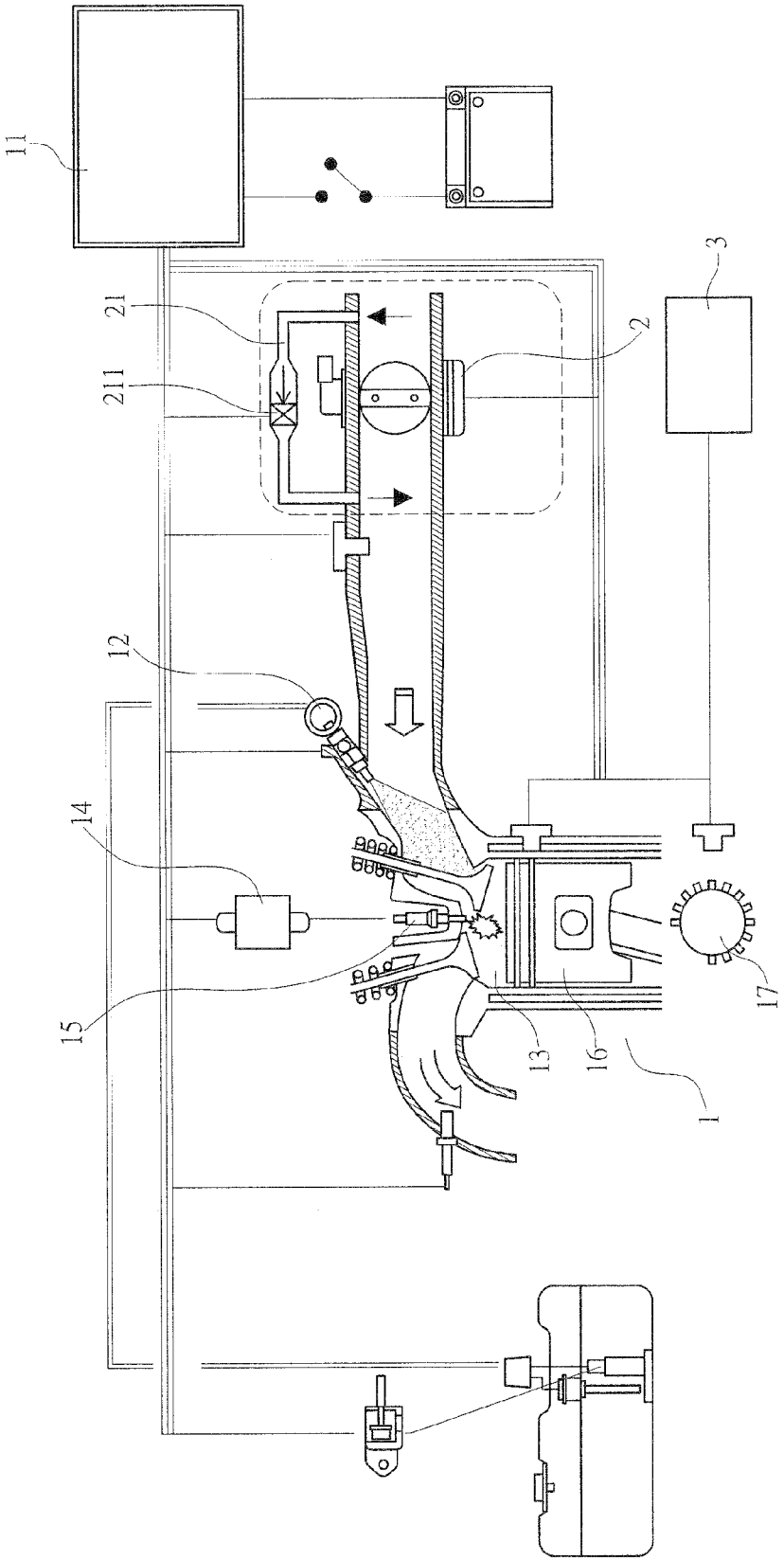
A control structure is provided for a throttle valve of engine. The throttle valve includes a throttle plate arranged inside the valve body and mounted to a control shaft having an end extending outside the valve body and received in a control seat mounted outside the valve body and having a shaft hole seat, a constraint block, a coupling hole seat, and a cable outlet section. A control assembly includes a return spring and a control rocker arm that includes a connection section forming a connection hole to be fit over the control shaft and a cable connection section, a positioning section, and a push section. The control motor is mounted to the coupling hole seat of the control seat and has a driving rod having a front tip section positioned against the push section of the control rocker arm. The control seat lid is secured to the control seat.

8 Claims, 7 Drawing Sheets





PRIOR ART
FIG.1



PRIOR ART
FIG.2

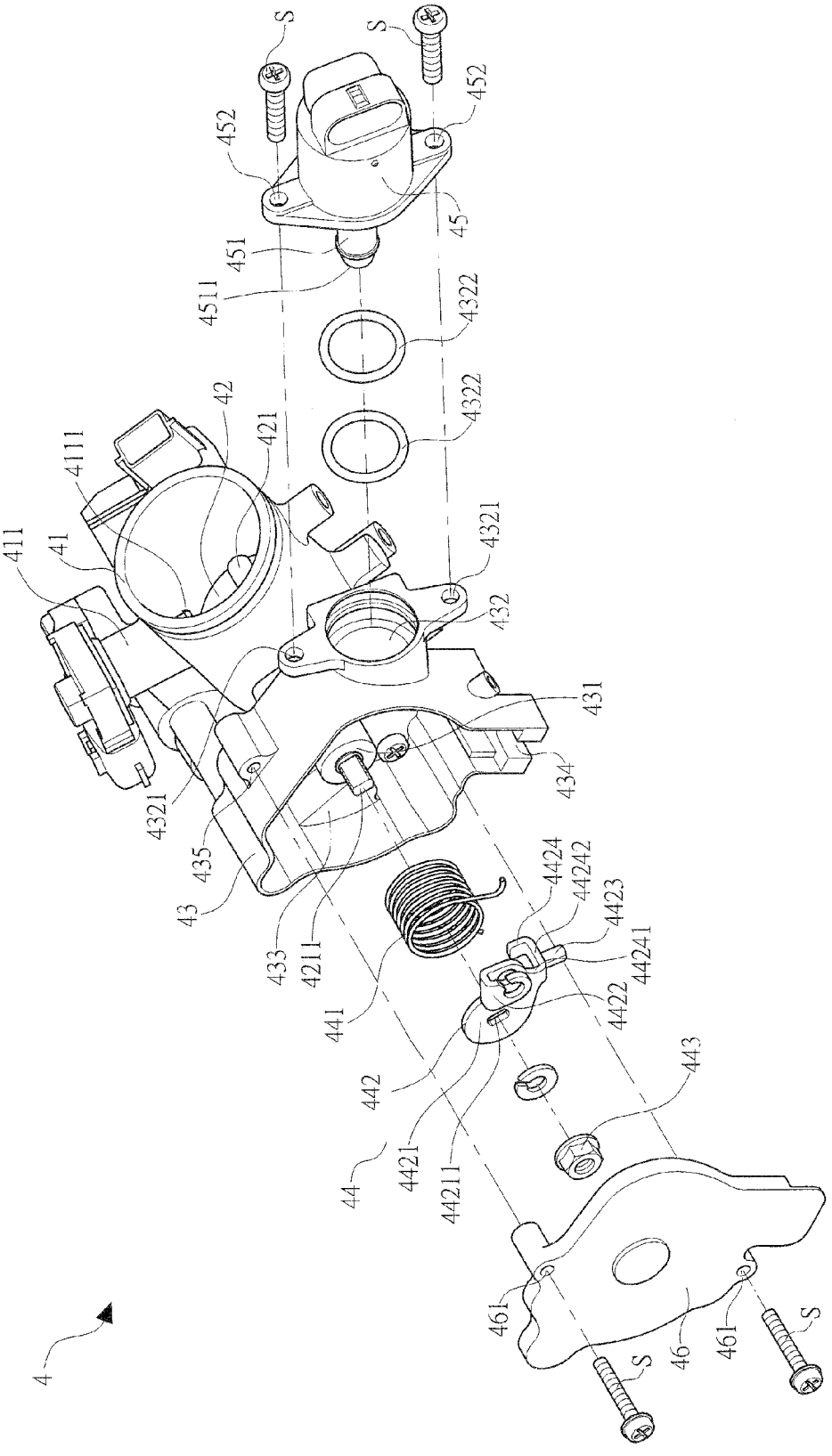

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FIG.3

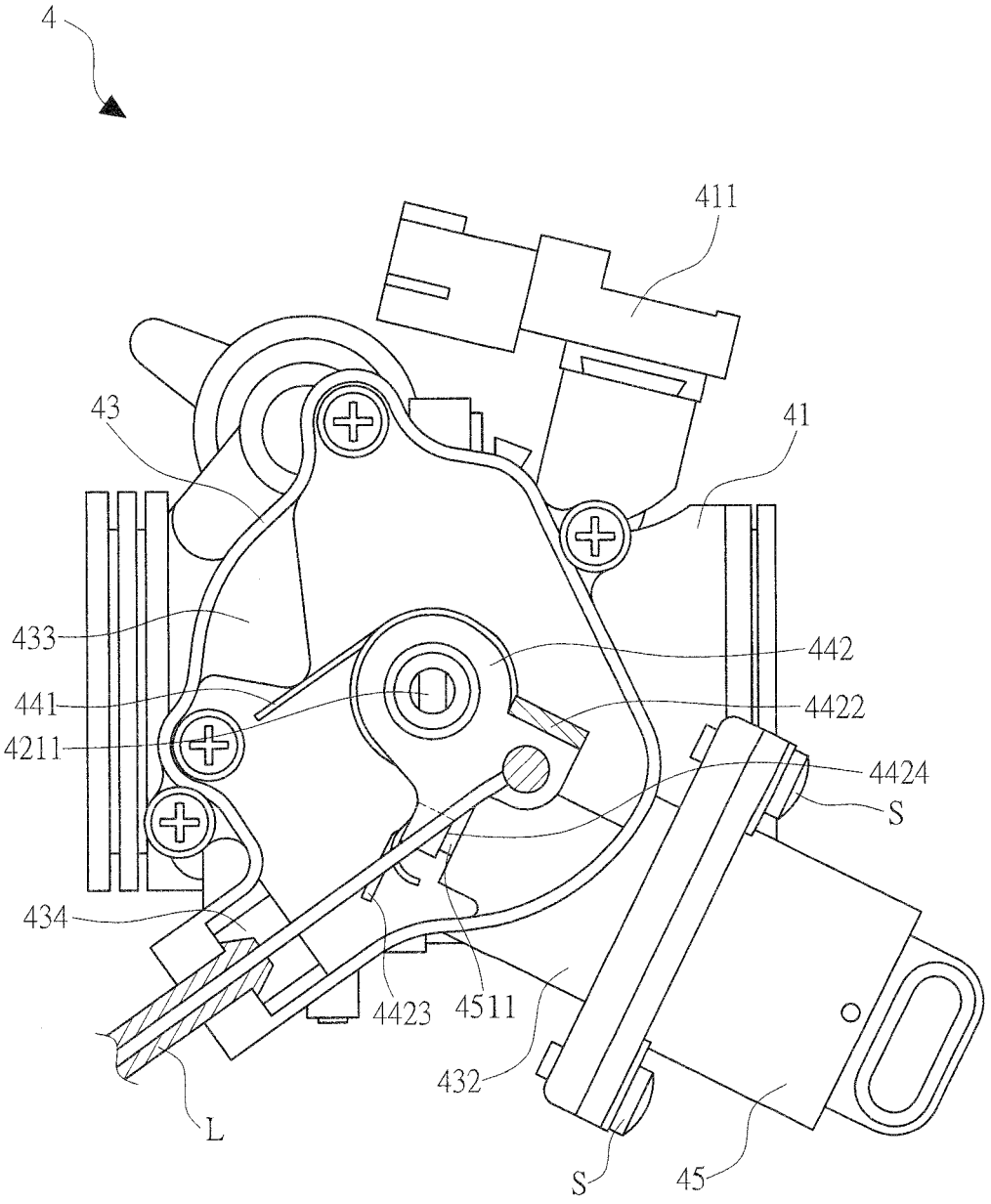

FIG.4

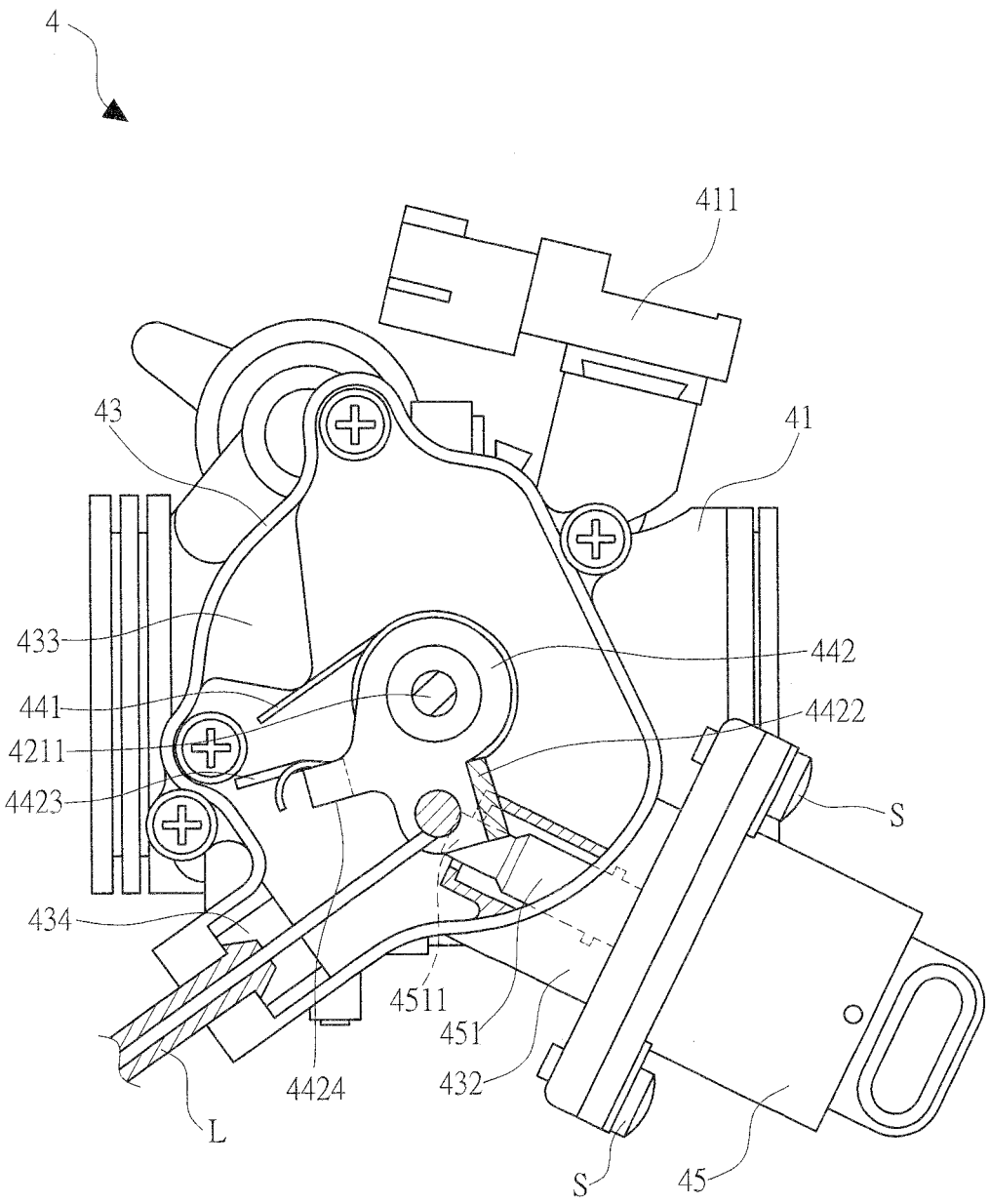
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FIG.5

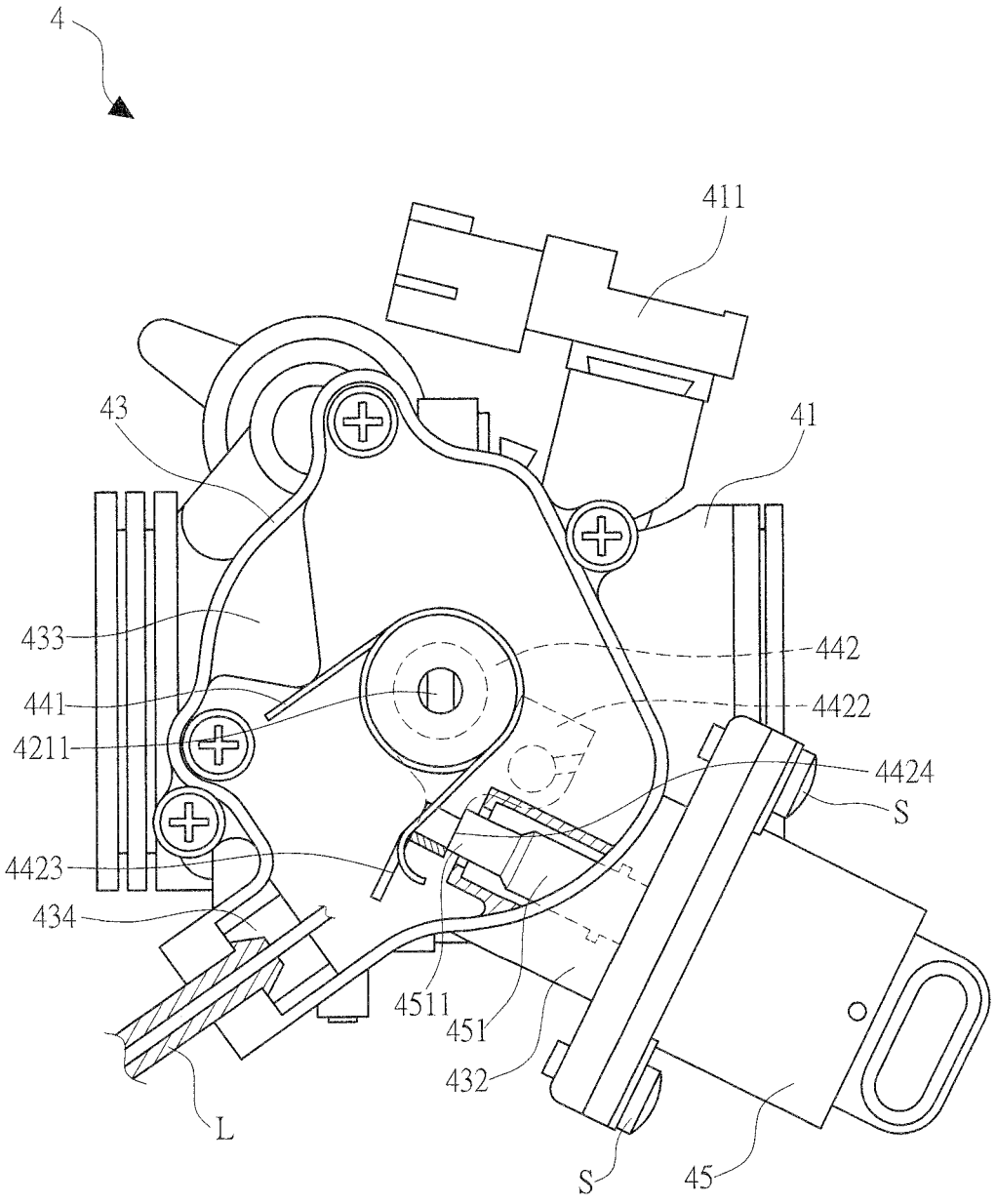
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FIG.6

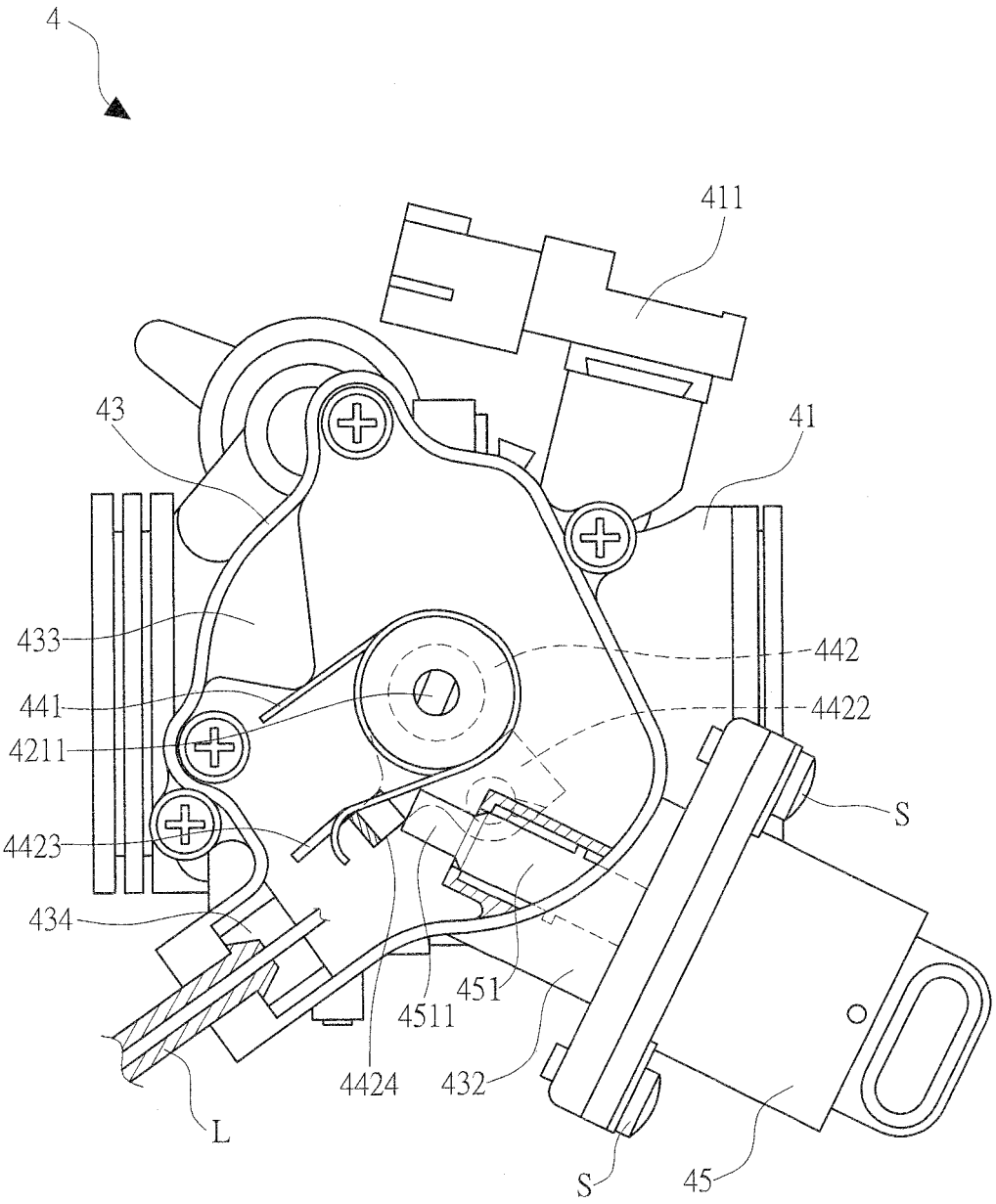
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FIG.7

CONTROL STRUCTURE OF ENGINE THROTTLE VALVE

(a) TECHNICAL FIELD OF THE INVENTION

The present invention generally relates to a control structure of engine throttle valve, and more particularly to an engine throttle valve structure that avoids increase of overall size of the throttle valve and at the same time simplifies the installation engineering of engine intake system so as to improve operation performance of the engine.

(b) DESCRIPTION OF THE PRIOR ART

Referring to FIG. **1**, the operation of an engine **1** is such that an electronic control unit (ECU) **11** controls to inject a proper amount of fuel into a combustion chamber **13** of the engine **1** through an injection device **12**. The fuel is mixed with external fresh air drawn in through a throttle valve **2** (a variable intake device) to form a fuel mist. The electronic control unit **11** issues an ignition signal to an ignition coil **14** to cause an ignition device (a spark plug) **15** to operate and flame the mist, so as to drive reciprocal motion of a piston **16**. The piston **16** in turn drives a crankshaft **17** to rotate thereby generating power.

When a vehicle is not in a driving status, the engine **1** is operated in a low sped (idle) so as to prevent the engine **1** from shutdown. When the engine **1** in the idle speed, the electronic control unit **11** reduces the amount of fuel injected from the injection device and supplies fresh air through an idle intake bypass passage **21** that is arranged beside the variable intake device **2**. The idle intake bypass passage **21** is provided with an electronic control valve **211**. The electronic control valve **211** controls the amount of external fresh air drawn in so as to maintain the engine **1** operating in a constant idle speed.

The conventional engine **1** uses the idle intake bypass passage **21** and the electronic control device **211** arranged beside the throttle valve **2** to maintain the constant idle speed of the engine **1** so as to keep the engine **1** from being shut down and reduce fuel consumption. As shown in FIG. **2**, the engine **1** is additionally coupled to a generator **3** or other power device. The generator **3** is activated only when the engine **1** is operating in the idle speed. This inevitably causes a great increase of loading of the engine **1**. To maintain normal operation of the additionally coupled generator **3**, the engine **1** must raises the operation speed thereof. The conventional way of intake for the engine **1** is obviously not capable of handling the instantaneous increase of loading when the engine **1** is in the idle speed and also the amount of intake air must be increased to meet the need of increasing speed of the engine **1**. Thus, it is a challenge of the vehicle manufacturing industry to provide a control structure of throttle valve **2** that allow the engine **1** to handle air intake for both non-loaded idling and loaded idling.

SUMMARY OF THE INVENTION

The primary technical solution of the present invention is to provide a control structure of throttle valve of engine. The throttle valve at least comprises a valve body, a throttle plate, a control seat, a control assembly, a control motor, and a control seat lid. The throttle plate is arranged inside the valve body and mounted to a control shaft having an end extending outside the valve body and received in the control seat. The control seat is mounted outside the valve body and comprises a shaft hole seat, a constraint block, a coupling hole seat, and a cable outlet section. The control assembly comprises a return spring and a control rocker arm that comprises a connection section forming a connection hole to be fit over the control shaft. The control rocker arm also comprises a cable connection section, a positioning section, and a push section. The control motor is mounted to the coupling hole seat of the control seat and has a front side where a driving rod is mounted. The driving rod has a front tip section positioned against the push section of the control rocker arm. The control seat lid is secured to the control seat. This arrangement prevents enlargement of the overall size of the throttle valve and simplifies the installation engineering of the engine intake system so as to improve the operation performance of the engine.

The foregoing objectives and summary provide only a brief introduction to the present invention. To fully appreciate these and other objects of the present invention as well as the invention itself, all of which will become apparent to those skilled in the art, the following detailed description of the invention and the claims should be read in conjunction with the accompanying drawings. Throughout the specification and drawings identical reference numerals refer to identical or similar parts.

Many other advantages and features of the present invention will become manifest to those versed in the art upon making reference to the detailed description and the accompanying sheets of drawings in which a preferred structural embodiment incorporating the principles of the present invention is shown by way of illustrative example.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic view illustrating the operation of a conventional engine.

FIG. **2** is a schematic view illustrating the operation of a conventional engine coupled to an external loading device.

FIG. **3** is an exploded view showing a throttle valve according to the present invention.

FIG. **4** is a perspective view showing the throttle valve.

FIG. **5** is a schematic view illustrating the maximum opening of the throttle valve according to the present invention.

FIG. **6** is a schematic view illustrating the operation of the throttle valve according to the present invention for engine low idling speed.

FIG. **7** is a schematic view illustrating the operation of the throttle valve according to the present invention for engine high idling speed.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The following descriptions are exemplary embodiments only, and are not intended to limit the scope, applicability or configuration of the invention in any way. Rather, the following description provides a convenient illustration for implementing exemplary embodiments of the invention. Various changes to the described embodiments may be made in the function and arrangement of the elements described without departing from the scope of the invention as set forth in the appended claims.

Firstly, referring to FIGS. **3** and **4**, the present invention provides a control structure of throttle valve of engine. The throttle valve **4** at least comprises a valve body **41**, a throttle plate **42**, a control seat **43**, a control assembly **44**, a control motor **45**, and a control seat lid **46**.

The valve body **41** has an outer circumference to which at least an intake pressure sensor **411** is mounted. The intake pressure sensor **411** has a detection terminal **4111** that

extends into the interior of the valve body **41** in order to detect the amount of air intake of the throttle valve **4**.

The throttle plate **42** is arranged inside the valve body **41**. The throttle plate **42** is mounted to a control shaft **421**, whereby the throttle plate **42** is rotatable about a rotation axis defined by the control shaft **421** and is thus allowed to do elevational swing motion inside the valve body **41**. The elevation angle that the throttle plate **42** takes is the angle that the throttle plate **42** opens inside the valve body **41** for air intake. The control shaft **421** has an end forming a threaded section **4211**. The threaded section **4211** of the control shaft **421** extends outside the valve body **41** to be received in the control seat **43**.

The control seat **43** is mounted outside the valve body **41**. The control seat **43** comprises a shaft hole seat **431**. The shaft hole seat **431** receives the extension of the threaded section **4211** of the control shaft **421**. The control seat **43** has one side forming a coupling hole seat **432**. The coupling hole seat **432** receives the control motor **45** to coupled thereto. The coupling hole seat **432** has two side projections forming two mounting holes **4321** respectively. The coupling hole seat **432** comprises therein sealing rings **4322**. The control seat **43** comprises a constraint block **433** that is located adjacent to the shaft hole seat **431** and is raised from the bottom. The coupling hole seat **432**, the shaft hole seat **431**, and the constraint block **433** are arranged to be substantially on a line. Precisely speaking, the shaft hole seat **431** is located between the coupling hole seat **432** and the constraint block **433**. The control seat **43** forms on one side thereof a cable outlet section **434**. The control seat **43** has an outer circumference forming a plurality of fixing holes **435**.

The control assembly **44** comprises a return spring **441** and a control rocker arm **442**. The control rocker arm **442** comprises a connection section **4421**. The connection section **4421** forms a connection hole **44211**. The connection hole **44211** is fit over the threaded section **4211** of the control shaft **421** with a locking nut **443** threadingly engaging the threaded section **4211** so as to couple the control rocker aim **442** to the threaded section **4211** of the control shaft **421**. The control rocker arm **442** also comprises a cable connection section **4422**, a positioning section **4423**, and a push section **4424**. The cable connection section **4422** is provided for connection with an accelerator cable L. The push section **4424** is formed by first extending downward from the cable connection section **4422** as a vertical segment **44241** and then sideways extending as a horizontal segment **44242** with a free end of the horizontal segment **44242** being made upward projecting. The positioning section **4423** comprises a projection peg extending downward. When the positioning section **4423** is brought into contact with the constraint block **433** of the control seat **43**, the throttle plate **42** is set at the maximum opening inside the valve body **41**. The return spring **441** has an end supported on the constraint block **433** of the control seat **43** and an opposite end supported on the push section **4424** of the control rocker arm **442**.

The control motor **45** can be a step motor. The control motor **45** is mounted to the coupling hole seat **432** of the control seat **43**. The control motor **45** has a front side where a driving rod **451** is provided. The driving rod **451** is driven by the control motor **45** to do linear extension/retraction. Further, the control motor **45** comprises two coupling holes **452** formed on side projections thereof. The coupling holes **452** are set to correspond to the mounting holes **4321** of the coupling hole seat **432** of the control seat **43**, whereby when the control motor **45** is fit into the coupling hole seat **432** of the control seat **43**, the threaded fasteners S can be put through the coupling holes **45** and the mounting holes **4321** of the coupling hole seat **432** to mount the control motor **45** to the coupling hole seat **432** of the control seat **43**. When the control motor **45** is mounted to the coupling hole seat **432** of the control seat **43**, a front tip section **4511** of the driving rod **451** of the control motor **45** is exactly positioned against the push section **4424** of the control rocker arm **442**.

The control seat lid **46** is arranged to correspond to the control seat **43**. The control seat lid **46** forms a plurality of through holes **461**. The through holes **461** respectively correspond to the fixing holes **435** of the control seat **43**, so that threaded fasteners S can be put through the through holes **461** and the fixing holes **435** to secure the control seat lid **46** to the control seat **43**.

To practice the present invention, referring to FIGS. **4**, **5**, **6**, and **7**, for a vehicle being not driven for a long time (namely the engine is in a cold condition), if a driver wishes to start the engine, at this moment, the throttle valve **4** is controlled by an electronic control unit (not shown) so that the control motor **45** of the throttle valve **4** is thus controlled by the electronic control unit to put the control motor **45** into operation, wherein the control motor **45** instructs the driving rod **451** to move forward by a small stroke. As shown in FIG. **6**, the driving rod **451** of the control motor **45** is set in contact with the push section **4424** of the control rocker arm **442** of the control assembly **44**, whereby when the driving rod **451** moves forward by a small stroke, the control rocker arm **442** is rotated simultaneously. The control rocker arm **442** causes the throttle plate **42** to make a small opening in the valve body **41** in order to bring in more intake air, allowing the engine to smoothly start even in the cold condition. Under this condition, the throttle plate **42** has a small opening in the valve body **41**, which means the control motor **45** controls the throttle plate **42** to provide a first idling opening. Precisely speaking, the control motor **45** controls the throttle plate **42** to provide such an opening that allows the air intake that is needed for the engine to start in a cold and load-free condition. When the engine is warmed up, the electronic control unit controls the control motor **45** to return and this allows the throttle plate **42** to return to the home position. Under this condition, the engine is supplied by the throttle valve **4** with an idling intake air that is necessary for the engine in a load-free condition to maintain continuous operation of the engine in an idle speed.

When the vehicle is in driving condition after being warmed up, the throttle valve **4** uses the accelerator cable L to actuate the control rocker arm **442** of the control assembly **44** and uses the control rocker arm **442** to have the throttle plate **42** open in the valve body **41** to such an opening degree that matches the rotation of the acceleration handgrip (not shown) made by a rider, so as to have the engine (not shown in the drawing) to output a proper amount of power for moving the vehicle forward, as shown in FIGS. **4** and **5**.

When the vehicle has been started but does not move, it is the idle condition. However, with the engine being in the normal idle condition, when a rider activates an external dynamo or other power device connected to the engine, the electronic control unit makes an immediate control for re-operating the control motor **45** to further move the driving rod **451** forward by a stroke, as shown in FIG. **7**, the driving rod **451** makes the control rocker arm **442** rotating again and the control rocker arm **442** makes the throttle plate **42** to open to an increased degree inside the valve body **41**. In other words, the control motor **45** controls the throttle plate **42** to provide a second idling opening. Precisely speaking, the control motor **45** controls the throttle plate **42** to provide such an opening that allows the air intakes that is needed for the engine in a loaded idling condition to thereby increase the amount of air intake of the throttle valve **4**, by which the

amount of air intake for maintaining the engine in a high idling speed is supplied to ensure the normal operation of the engine in high loading and high idling speed.

The efficacy of the present invention is that a control seat **42** is provided on the throttle valve **4** and the control seat **42** comprises a control motor **45** mounted thereto. The control motor **45** is controlled by an electronic control unit and the control motor **45** is in operative coupling with the control rocker arm **442** of the control assembly **44**. This prevents enlargement of the overall size of the throttle valve **4** and simplifies installation engineering of the engine intake system to thereby improving the performance of engine.

It will be understood that each of the elements described above, or two or more together may also find a useful application in other types of methods differing from the type described above.

While certain novel features of this invention have been shown and described and are pointed out in the annexed claim, it is not intended to be limited to the details above, since it will be understood that various omissions, modifications, substitutions and changes in the forms and details of the device illustrated and in its operation can be made by those skilled in the art without departing in any way from the spirit of the present invention.

We claim:

1. A control structure of a throttle valve of an engine, the throttle valve at least comprising a valve body, a throttle plate, a control seat, a control assembly, a control motor, and a control seat lid:

the throttle plate being arranged inside the valve body, the throttle plate being mounted to a control shaft, the control shaft having an end extending outside the valve body and received in the control seat;

the control seat being mounted outside the valve body, the control seat comprising a shaft hole seat, a constraint block, a coupling hole seat, and a cable outlet section, wherein the coupling hole seat has outside projections forming mounting holes, the coupling hole seat receiving therein a sealing ring, the shaft hole seat being located between the coupling hole seat and the constraint block;

the control assembly comprising a return spring and a control rocker arm, the control rocker arm comprising a connection section, the connection section forming a connection hole, the connection hole being fit over the control shaft, the control rocker arm comprising a cable connection section, a positioning section, and a push section, wherein the return spring has an end supported on the constraint block of the control seat and an opposite end supported on the push section of the control rocker arm; wherein the push section consists of a horizontal segment attached to the cable connection section by a first vertical segment, and a second vertical segment that extends toward, but does not contact the cable connection section;

the control motor being mounted to the coupling hole seat of the control seat, the control motor having a front side where a driving rod is mounted, the driving rod having a front tip section positioned against the push section of the control rocker arm, the control motor having side projections forming coupling holes, the coupling holes corresponding to the mounting holes of the coupling hole seat of the control seat; and

the control seat lid being secured to the control seat.

2. The control structure of a throttle valve of an engine as claimed in claim **1**, wherein the control motor is controlled by an electronic control unit to operate.

3. The control structure of a throttle valve of an engine as claimed in claim **1**, wherein the valve body has an outer circumference to which at least an intake pressure sensor is mounted, the intake pressure sensor having a detection terminal extending into the valve body.

4. The control structure of a throttle valve of an engine as claimed in claim **1**, wherein the control shaft has an end forming a threaded section, the threaded section of the control shaft extending outside the valve body and received in the control seat, the control rocker arm being mounted to the threaded section of the control shaft.

5. The control structure of a throttle valve of an engine as claimed in claim **1**, wherein the control motor controls the throttle plate to switch between a first idling opening and a second idling opening.

6. The control structure of a throttle valve of an engine as claimed in claim **5**, wherein the control motor controls the throttle plate forming the first idling opening to provide air intake for the engine in a cold and load-free condition.

7. The control structure of a throttle valve of an engine as claimed in claim **5**, wherein the control motor controls the throttle plate forming the second idling opening to provide air intake for the engine in a loaded idling condition.

8. The control structure of a throttle valve of an engine as claimed in claim **1**, wherein the positioning section comprises a projection peg extending downward, whereby when the positioning section is put in contact with the constraint block of the control seat, the throttle plate is set at a maximum opening in the valve body.

* * * * *